

Application No. 09/877,311  
Amendment Dated March 31, 2005  
Reply to the Office Action dated November 1, 2004

The attached sheet of drawings includes changes to Fig. 1. This sheet, which includes Fig. 1 replaces the original sheet including Fig. 1. In Fig. 1 the element number "CMA2" was corrected to read "CMA1."

Attachment:                      Replacement Sheet  
   Annotated Sheet Showing Changes (Appendix Exhibit 2)

**Remarks**

Claims 1-20 of the application are pending.

Claims 11, 14 - 16, 19 and 20 are allowed.

Claims 1-10, 12, 13, 17 and 18 stand rejected.

Claim 2 has been cancelled without prejudice.

Claims 1, 3, 5, 7, 8, 12, 13, 15 and 17 - 19 have been amended.

Claims 1 and 3 - 20 are hereby presented for review.

No new matter has been added.

In paragraphs 1 and 2 of the Office Action, the Examiner has rejected claims the claim for priority and not entered the amendment to the specification from the prior preliminary amendment. Applicants respectfully resubmit the amendment to the specification with this amendment noting the correct filing date for the claims priority. As indicated on the filing receipt, the correct filing date for U.S. Provisional Patent Application No. 60/262,125 is January 16, 2001, well within one year of the filing date of the present application. A copy of the filing receipt for the '125 application is enclosed for the examiner's review in the Appendix as Exhibit 1.

In paragraph 2 of the Office Action, the Examiner has rejected Fig. 1 because it does not show the appropriate description for the element number "CMA1" as described

in line 12 on page 6 of the application. Applicants have amended claim 1 accordingly by changing element "CMA2" in original Fig. 1 to read "CMA1."

Applicants note that this change to Fig. 1 is entirely supported by the original application as filed, particularly in the description in the first paragraph on page 6 of the specification. As such, no new matter has been added to this Figure.

In paragraph 5 of the Office Action, the Examiner has rejected claims 5-10, 12, 13, 17 and 18 under 35 U.S.C. § 112 for lack of enablement because of the inclusion of the element "sampler." Applicants have removed the term "sampler" from the affected claims, amended them to properly reflect the intended scope of the invention and respectfully request that the rejection be withdrawn.

In paragraph 6 of the Office Action, the Examiner has rejected claims 1-4 under 35 U.S.C. § 112 because the term "N" is not properly defined. Applicants have amended claim 1 to include the definition of "N" and respectfully request that the rejection be withdrawn.

Also, although not rejected by the Examiner, Applicants have also amended claims 3, 8, 15 and 19 to correct a minor error, by amending " $\hat{I}_k$ " to be the equalizer output which was inadvertently left out of the claims as filed.

In paragraph 9 of the Office Action, the Examiner has rejected claims 1 and 2 under 35 U.S.C. § 103(a) as being unpatentable over Malkemes et al. (U.S. Patent Publication No. 2002/0054655 in view of Endres et al. (U.S. Patent No. 6,418,164). Applicants note that in paragraph 10 of the Office Action, the Examiner has allowed claims 11, 14-16 and 19-20.

Applicants respectfully disagree with the Examiner's substantive rejections and

submit the following remarks in response.

The present invention as claimed in independent claim 1 is directed to an adaptive antenna system having  $N$  antennae, where  $N$  is an integer greater than 1.  $N$  forward equalizers are operatively coupled to a respective one of the  $N$  antennae.  $N$  processors perform a constant modulus algorithm (CMA) to generate  $N$  respective control signals which adapt coefficients associated with each respective one of the forward equalizers.

A decision device receives a signal based on the collected output of the  $N$  forward equalizers and a feedback equalizer receives an output of the decision device and generates a feedback signal, biasing the signal received by the decision device. A control signal generated by one of the  $N$ th processor adapts coefficients associated with the feedback equalizer where a second control signal *independent from the feedback equalizer* is generated by a second processor among the  $N$  processors so as to adapt coefficients for a corresponding forward equalizer.

In this arrangement as noted on page 9 paragraph 2 of the specification,

“It will be appreciated that the signal at the output of Forward Equalizer FE2 advantageously can be employed to adapt the coefficients of that forward equalizer based on a blind adaptation algorithm; the antenna connected to the Forward Equalizer FE2 can be referred to as “the independent antenna.” In contrast, the signal at the output of the Forward Equalizer FE1 could be used to adapt the coefficients of the Forward Equalizer FE1 and the Feedback Equalizer FBE based on another blind adaptation algorithm. This is shown in Fig. 2. Hence, two error signals would be created; all of the coefficients employed in the adaptive DBBF antenna system 100 would not be based on one adaptation algorithm.”

Furthermore, as noted in the last paragraph on page 10 of the specification, the

present invention states:

“Advantageously, this novel adaptation structure gives the adaptive DBBF antenna system another degree of freedom that is not available in antennas employing the single error adaptive antenna algorithm. In other words, while it is not possible to build multiple degrees of freedom in a standard single antenna employing a Decision Feedback Equalizer (DFE) structure, it is both possible and practical to introduce multiple degrees of freedom in a multiple antenna DFE structure.”

Such an arrangement is in sharp contrast to the cited prior art. The Malkemes reference, teaches a method and apparatus for reducing multipath distortion in a wireless LAN system. Paragraph [0021] of Malkemes, relating to Fig. 2 states:

“The carrier/slicer circuit 206 comprises a carrier recovery loop that extracts the carrier from the equalized symbols and a slicer circuit that samples the symbols to generate estimated symbols. The carrier recovery loop is used to correct for any frequency or phase offset in the received signal, thus mitigating some of the Doppler effects. The output of the carrier/slicer circuit 206 is coupled to the DFE 208 for temporal equalization and the removal of intersymbol interference. *The output of the DFE 208 is coupled back to the combiner 204.* The slicer in the carrier/slicer circuit 206 and subtractor 212 are used to produce a symbol error that is coupled to the tap control 210, that is, the slicer together with the subtractor 212 compares the estimated symbol sample with the closes known symbol and generates an error signal. *The tap control 210 uses the error signal to produce tap weight adjustments for all the equalizers: the spatial equalizers 202<sub>1</sub>-202<sub>L</sub> and the DFE 208.* The operation of the tap control 210 is discussed below.” (emphasis added)

As such, it is evident that *all* of the FFEs (labeled as spatial equalizers 202<sub>1</sub>-202<sub>L</sub>) are adjusted based on the output of the feedback equalizer DFE 208.

Turning to the next reference, Endres teaches an adaptive equalizer with enhanced error quantization. As illustrated in Fig. 3, the output of the feedback equalizer 74 using constant modulus algorithm (CMA) is coupled to adder 66 which feeds back into slicer

circuit 68. Thus, in this arrangement the output of feedback equalizer 74 is used for correcting the output of forward equalizer 60.

However, neither of the prior art references, either alone or in combination with one another, teach or suggest the present invention as claimed. For example, there is no teaching or suggestion in either Malkemes or Endres that discloses the a control signal generated by on of the Nth processors adapting coefficients associated with the feedback equalizer *and* where a second control signal *independent from the feedback equalizer* is generated by a second processor among the N processors so as to adapt coefficients for a corresponding forward equalizer.

As noted above in Malkemes, the output of feedback equalizer 208 affects all of the forward equalizers 202. Thus, there is no teaching for a second control signal to adapt coefficients independent from the feedback equalizer. Likewise, there is only one forward equalizer in Endres and it is effected by the output of the feedback equalizer. There is no second control signal to adapt coefficients independent from the feedback equalizer

As such, Applicants submit that the cited prior art does not teach the present invention as claimed and respectfully request the rejection of claim 1 be withdrawn. Further, as claim 5 contains at least one similar element to that discussed above, this claim should be allowed for the same reason. Additionally, as claims 3-4 and 6-10 depend from claims 1 and 5 respectively, these claims should also be allowed for the same reasons set forth above.

In view of the forgoing, Applicants respectfully submit that the claims of the present invention are in condition for allowance, the earliest possible notice of which is

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earnestly solicited. If the Examiner feels that an interview would facilitate the prosecution of this Application he is invited to contact the undersigned at the number listed below.

Respectfully submitted,

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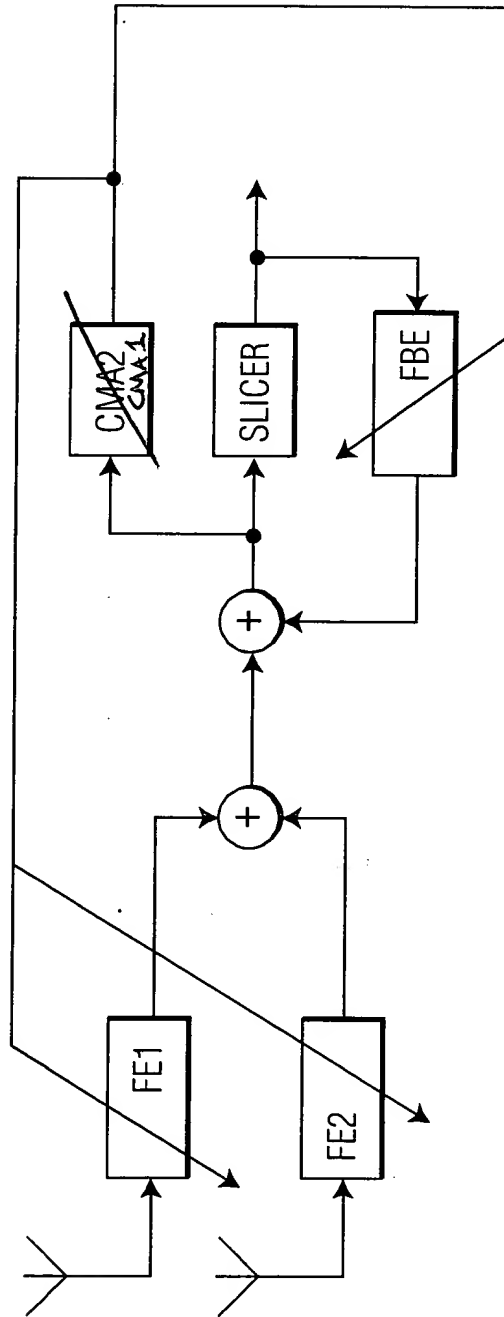


FIG. 1